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VERIFICATION OF TRANSLATION

I, undersigned below, hereby declare that:

My name and post office address are as stated below:

That I am knowledgeable in the English language and in the language in which the below identified U.S. Provisional Application was filed, and that I believe the attached English translation of the U.S. Provisional Application No. 60/430,190 filed on December 2, 2002 is a true and complete translation of the above-identified Provisional Application as filed.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: December 19, 2002

Full Name of the Translator: Koichi Yabana

Signature of the translator: Yabana

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[What is claimed is]

[Claim 1]

An electric motor-operated vehicle comprising:

a seat located in about the center of a vehicle body,

a loading platform located behind said seat to hold baggage,

main frame rails disposed in the longitudinal direction and in the lower part of said vehicle body,

a loading platform receiving frame connected to said main frame rails,

an electric motor for driving the vehicle,

batteries for supplying power to said electric motor,

a fuel cell for charging said batteries,

fuel tanks connected to said fuel cell, and

an electric motor controller for drive-controlling said electric motor,

wherein said fuel tanks are placed in about the center of the vehicle width, said fuel cell is placed in front of said fuel tanks and under said seat, a partition wall having a vent opening is placed between said fuel tanks and said fuel cell, a fan is provided to cool said fuel cell, and cooling air is drawn with said fan into said fuel cell holding area and vented rearward through said opening formed in the partition wall.

[Claim 2]

The electric motor-operated vehicle according to Claim 1, wherein said batteries are mounted on the right and left sides of said fuel tanks, the space in front of said batteries is open to the right and left sides of said fuel cell holding area, part of the air drawn into the open space from the outside of the

vehicle body is drawn into said fuel cell holding area from the right and left sides thereof through filters to cool said fuel cell, and the air in said open space is caused to flow directly rearward to cool said batteries.

[Claim 3]

The electric motor-operated vehicle according to Claim 1, wherein said motor controller is located behind said fuel tanks.

[Claim 4]

The electric motor-operated vehicle according to Claim 1, wherein said opening in said partition wall is provided with an air vent direction switching means.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to an electric motor-operated vehicle with a fuel cell, in particular to the arrangement for cooling components related to the fuel cell held in the vehicle body.

[0002]

[Prior Art]

Electric motor-operated vehicles using the fuel cell have been in practical use as golf carts and other simple vehicles for carrying objects. The electric motor-operated vehicle here is constituted with: a seat located in about the center of a vehicle body, a loading platform located behind the seat to hold baggage, main frame rails disposed in the longitudinal direction and in the lower part of the vehicle body, a loading platform receiving frame connected to the main frame rails, an electric motor for driving the vehicle, batteries for supplying power to the electric motor, a fuel cell for charging the batteries, fuel tanks connected to the fuel cell, and an electric motor controller for drive-controlling the electric motor.

[0003]

The fuel cell is generally a generator that converts the

chemical energy, released when water is produced by the reaction of hydrogen and oxygen, into electric energy to be taken out. The solid polymer electrolyte fuel cell (PEFC) is in practical use that is capable of generating electricity at a low working temperature range of about 70 to 90 degrees C using an ion exchange membrane as the electrolyte, and pure hydrogen, or hydrogen extracted by reforming methanol, natural gas, or gasoline, as the fuel.

[0004]

While the chemical reaction occurring when the fuel cell generates electricity releases heat, related devices must be effectively cooled in order to generate electricity with high efficiency and reliability.

[0005]

An electric motor-operated vehicle with the conventional fuel cell is disclosed in the reference patent literature No. 1. The cooling structure of the electric motor-operated vehicle in the patent literature No. 1 is arranged that the fuel cell is cooled using a heat exchanger, a cooling medium, and a cooling fan for cooling the cooling medium. As a result, the arrangement is large, complicated, and heavy.

[0006]

[Reference Patent Literature No. 1]

United States Patent No. 6,448,535

[0007]

[Problems to be Solved by the Invention]

The present invention has been made in view of the prior art with an object of providing an electric motor-operated vehicle in which the fuel cell and its related devices are cooled efficiently with a simple constitution.

[0008]

[Means for Solving the Problems]

To accomplish the above object, the present invention provides an electric motor-operated vehicle comprising: a seat

located in about the center of a vehicle body, a loading platform located behind the seat to hold baggage, main frame rails disposed in the longitudinal direction and in the lower part of the vehicle body, a loading platform receiving frame connected to the main frame rails, an electric motor for driving the vehicle, batteries for supplying power to the electric motor, a fuel cell for charging the batteries, fuel tanks connected to the fuel cell, and an electric motor controller for drive-controlling the electric motor, wherein the fuel tanks are placed in about the center of the vehicle width, the fuel cell is placed in front of the fuel tanks and under the seat, a partition wall having a vent opening is placed between the fuel tanks and the fuel cell, a fan is provided to cool the fuel cell, and cooling air is drawn with the fan into the fuel cell holding area and vented rearward through the opening formed in the partition wall.

[0009]

With the above constitution, the fuel cell is partitioned with the partition wall and forcibly air-cooled with the fan, so that the fuel cell is cooled efficiently with the simple structure.

[0010]

In a preferable constitutional example, the batteries are mounted on the right and left sides of the fuel tanks, the space in front of the batteries is open to the right and left sides of the fuel cell holding area, part of the air drawn into the open space from the outside of the vehicle body is drawn into the fuel cell holding area from the right and left sides thereof through filters to cool the fuel cell, and the air in the open space is caused to flow directly rearward to cool the batteries.

[0011]

With the above constitution, the air flow caused as the vehicle runs is drawn for example from the front right and left sides of the vehicle body and caused to flow through the battery

holding area on the right and left sides of the vehicle interior to cool the batteries. The air is also drawn with the fan to the fuel cell holding area to cool the fuel cell.

[0012]

In another preferable constitutional example, the motor controller is placed behind the fuel tanks.

[0013]

With the above constitution, the motor controller is separated from the fuel cell, a heat source, through the fuel tanks interposed in between, so that the motor controller is less affected with the heat to maintain reliable control function.

[0014]

In still another preferable constitutional example, the opening in the partition wall is provided with an air vent direction switching means.

[0015]

The above constitution makes it possible, in summer, to release the waste hot air directly through the opening behind the vehicle and, in winter, to direct the hot air to the riders on the seat to make the drive comfortable.

[0016]

[Embodiments of the Invention]

FIGs. 1 to 4 are respectively a top view, a side view, a front view, and a back view of an electric motor-operated vehicle to which the present invention is applied.

The electric motor-operated vehicle 1 comprises: a vehicle body 2, a seat 3 located in the approximate center of the vehicle body 2, and a steering wheel 4 located in front of the seat 3. The area in front of the wheels 5 are covered with a cowl 6 from above. Main frame rails 7 made of pipe material are located under the vehicle body 2. Side frame rails 12 are located outside the main frame rails 7. A loading platform 9 for holding baggage is located behind the seat 3 and above the rear wheels

8. The lower front side of the seat 3 and the sides of the vehicle body are covered with a vehicle body cowl 10.

[0017]

FIG. 5 shows the constitution of the vehicle body frame of the electric motor-operated vehicle.

The rear ends of the paired right and left main frame rails 7 disposed in the longitudinal direction of the vehicle body are interconnected through a cross member 11. To the rear end of each main frame rail 7 is secured a bracket 13. The loading platform receiving frame 14 is a three-sided frame having right and left side rails 14a and 14b. The rear ends of the side rails 14a and 14b are respectively connected to the brackets 13. The middle portion and the front portion of the loading platform receiving frame 14 are secured and supported through struts 15 on the main frame rails 7. A floor plate 16 is placed on part of the main frame rails 7 in the front part of the vehicle body.

[0018]

FIG. 6 is a wire routing diagram of the electric motor-operated vehicle.

A brake pedal 17 is provided on the floor plate 16. The brake pedal 17 is connected to the right front wheel brake cable 18, the left front wheel brake cable 19, the right rear wheel brake cable 20, and the left rear wheel brake cable 21. An accelerator pedal (not shown) is provided on the floor plate 16 and connected to a throttle cable 22. The throttle cable 22 is connected to an electric motor (not shown). A shift cable 23 is used to switch between forward and reverse motion.

[0019]

FIGs. 7 and 8 show the constitution, in plan view and side view, of the electric motor-operated vehicle as an embodiment of the present invention.

A DC/DC converter 24 is provided in the front cowl 6, above the main frame rails 7. The DC/DC converter 24 is to step up the voltage produced with the fuel cell. The DC/DC converter

24 is preferably placed in the depression formed in the central part of the front cowl 6 as seen in front view. In this way, the air that flows over the depression as the vehicle runs can effectively cool the DC/DC converter 24 placed in the depression.

[0020]

As shown in FIG. 5 and described above, the loading platform receiving frame 14 is fixed and supported on the main frame rails 7 through struts 15 and brackets 13. A loading platform 9 is mounted and supported on the loading platform receiving frame 14. Two hydrogen tanks 25 are placed, with their longitudinal direction parallel to the longitudinal direction of the vehicle body, behind the seat 3 and between the raised portions of the right and left main frame rails 7 (See FIG. 8). The two hydrogen tanks 25 are placed on base seats 26 and positioned not to be displaced in longitudinal and lateral directions (See FIG. 10).

[0021]

Batteries 27, two for each side, are placed on both sides of the two hydrogen tanks 25. The batteries 27 are mounted and held along inside the right and left side rails 14a and 14b of the loading platform receiving frame 14. Partition walls 28 made of plastic material (or steel sheet) are placed between the hydrogen tanks 25 and the batteries 27. The partition walls 28 serve to increase the strength of the vehicle body frame, protect the hydrogen tanks 25 and the batteries 27, and improve cooling efficiency for the batteries by guiding the air flow, introduced from the front part as the vehicle runs, to flow along the top and both sides of the batteries 27.

[0022]

A fuel cell holding section 29 is formed under the seat 3 and on the main frame rails 7 to hold the fuel cell unit 30 therein. A cooling fan 31 is provided on the bottom of the fuel cell unit 30. Right and left sides of the fuel cell holding

section 29 are open and provided with filters 32.

[0023]

A partition wall 33 of an inverted L-shape cross section in side view, made of plastic material or steel sheet, is placed between the fuel cell holding section 29 and the hydrogen tanks 25 located behind the fuel cell holding section 29. As shown in the oblique view of FIG. 9, the partition wall 33 consists of the top portion 33a and the vertical wall portion 33b. A vent opening 34 is formed in the central upper part of the vertical wall portion 33b.

[0024]

Air intake openings 35, open to the front and sides, are provided in the right and left sides and the front side of the vehicle body cowl 10. To the air intake openings 35 are attached covers (not shown) made in a louver or labyrinth structure to prevent water and foreign matter from entering.

[0025]

Part of the external air (wind caused as the vehicle runs) taken through the air intake openings 35 into the vehicle body 2 as indicated with the arrows A is drawn, through the filters 32 with the fan 31 as indicated with the arrows A1, into the fuel cell holding section 29 to cool the fuel cell unit 30. The air warmed as it cools the fuel cell unit 30 is discharged through the vent opening 34 in the partition wall 33 as indicated with the arrows B toward the hydrogen tanks 25.

[0026]

The external air taken in through the air intake openings 35 as indicated with the arrows A flows directly as indicated with the arrows A2 to cool the batteries 27. At this time, since the batteries 27 are separated from the hydrogen tank side with the partition walls 28, the batteries 27 are effectively cooled with the wind caused as the vehicle runs, and less affected with the warm air indicated with the arrows B.

[0027]

An electric motor 36 is located behind the hydrogen tanks 25, and an electric motor control unit (MCU) 37 is located behind the electric motor 36. Locating the electric motor control unit 37 as far apart as practicable from the fuel cell unit 30 makes it possible to lessen the thermal effect from the fuel cell unit 30.

[0028]

FIG. 9 is an oblique view of the partition wall disposed between the fuel cell and the hydrogen tank.

As shown and as described before, the partition wall 33 consists of the top portion 33a and the vertical wall portion 33b, with the vent opening 34 provided in the central upper part of the vertical wall portion 33b. The fuel cell unit 30 is protected from above with the top portion 33a.

[0029]

FIG. 10 is a sectional view of the area where the hydrogen tanks are placed.

Receiving plates 38 are secured to the outer sides of the right and left main frame rails 7, and the batteries 27 are placed on the receiving plates 38. The hydrogen tanks 25 are placed on the base seats 26 for preventing lateral displacement, and securely held to the base seats 26 as tightened with a holding fitting 39.

[0030]

FIG. 11 shows another example of the partition wall between the fuel cell and the hydrogen tank.

In this example, the partition wall 33 is provided, at its opening 34, with a switching cover 40 that can be switched, as indicated with the arrow C, between a deflecting position (solid line) and a straightforward position (broken line). With the cover 40 in the straightforward position (broken line), heated air to be discharged flows straight toward the inside rear of the vehicle (as indicated with the arrow E in FIG. 11 and arrows B in FIGs. 7 and 8). With the cover 40 in the deflecting position

(solid line), heated air to be discharged is deflected upward to flow along the arrow D and directed toward the seat 3, so that riders on the seat 3 are warmed in the winter.

[0031]

FIG. 12 shows an example of how the hydrogen tank is laid out in another embodiment of the present invention, with the drawing (A) being a plan view and (B) a side view.

In this example, the hydrogen tank 25 is placed at an angle to the longitudinal direction of the vehicle body as seen in both plan view and side view, drawings (A) and (B). In this way, the tank of a large capacity can be mounted in a limited space.

[0032]

FIG. 13 shows how the piping is routed according to the present invention.

A first fuel supply port 41 and a second fuel supply port 42 are provided at the end of a fuel pipe 43. The first and second fuel supply ports 41 and 42 are respectively provided with a check valve (not shown). The fuel pipe 43 is connected through a check valve 44 to the two hydrogen tanks 25. The filler inlet 45 of each hydrogen tank 25 is provided with a manual valve. A relief valve 46 is provided in a line branching from the pipe 43 between the two hydrogen tanks 25. A fuel drawing pipe 47 branches from the pipe 43 on the downstream side of the hydrogen tank 25 and is provided with a manual valve 55. On the downstream side of the fuel drawing pipe 47 are provided a filter 48, a pressure regulator 49, a lock-off valve 50, and a flowmeter 51. The lock-off valve 50 is an automatic valve to open when the fuel cell is used and to close under abnormal conditions such as a low pressure.

[0033]

The pipe 43 is connected to the fuel cell unit 30 on the downstream side of the flowmeter 51. Air is supplied to the fuel cell unit 30 with an air pump 53 through an air pipe 52

as indicated with the arrow F. As electricity is generated by the reaction of hydrogen from the pipe 43 and air (oxygen) from the air pipe 52, water is produced and drained through a drain pipe 54.

[0034]

DC voltage generated with the fuel cell is supplied through a DC/DC converter (booster) 24 to the electric motor control unit 37 to drive the electric motor 36.

[0035]

FIG. 14 is a plan view showing how the piping shown in FIG. 13 is laid on the vehicle body. FIG. 15 is a partial elevation as seen from the front of the vehicle body.

As shown, the pipe 43 is routed across and along the inside of the right and left side rails 14a, 14b of the loading platform receiving frame 14 to surround the hydrogen tanks 25, while maintaining sufficient distance from them. The first and second fuel supply ports 41 and 42 are placed in positions below the rear part of the loading platform 9 and covered from above. As shown in FIG. 15, the pipe 43 is laid with several upward and downward bends. Laying the pipe 43 along a substantial length and with bends as described above increases the flexibility of the piping, makes it possible to absorb vibration and to secure the pipe 43 to the vehicle body frame in a stabilized manner.

[0036]

FIGs. 16 and 17 show how the drain pipe of the fuel cell unit is located.

As shown, the drain pipe 54 of the fuel cell unit 30 is located in the central part of the vehicle width and directed downward. In this way, water drained from the fuel cell is discharged between both of the right and left wheels. Therefore, the water dropped onto the road surface is less likely to be run over with the wheels, so that the vehicle can run in a stabilized manner.

[0037]

FIG. 18 is a plan view of another example of pipe layout.

In this example, the filler inlets 45 of the hydrogen tanks 25 are located on the rear side of the hydrogen tanks 25 to shorten the pipe length. This example, like the previous example, is arranged to route the fuel pipe 43 across the right and left side rails 14a, 14b of the loading platform receiving frame 14 and with several upward and downward bends, so that the piping is provided with flexibility for absorbing vibration, flow resistance is reduced, and fuel supply is made smooth by shortening the pipe length.

[0038]

FIGs. 19 and 20, plan view and side view, show another embodiment of the present invention.

This embodiment is arranged with the fuel cell unit 30 located in front of the seat 3. This makes it possible to arrange that the front ends of the hydrogen tanks 25 project to the position under the seat 3 to increase the tank capacity. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0039]

FIGs. 21 and 22 show still another embodiment of the present invention in plan view and side view.

This embodiment is arranged with the fuel cell unit 30 located behind the hydrogen tanks 25. In this way, the front ends of the hydrogen tanks 25 are made to project under the seat 3 to increase the tank capacity. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0040]

FIGs. 23 and 24 show still another embodiment of the

present invention in plan view and side view.

This embodiment is arranged that the electric motor 36 is located in a lowered position on which the fuel cell unit 30 is located. In this way, the front ends of the hydrogen tanks 25 are made to project under the seat 3 and the rear ends are also made to extend rearward, so that the tank capacity is further increased. This makes it possible to increase the travel range per one tank filling. Other points such as constitution, functions and effects are the same as with the embodiment shown in FIGs. 7 and 8.

[0041]

[Effects of the Invention]

As described above, this invention is arranged that the fuel cell is partitioned with the partition wall and forcibly air-cooled with the fan, so that the fuel cell is efficiently cooled with a simple constitution.

[0042]

It is constituted that the batteries are placed on the right and left sides of the fuel tanks, the space in front of the batteries is open to the right and left sides of the fuel cell holding area, part of the air drawn into the open space from the outside of the vehicle body is drawn into the fuel cell holding area from the right and left sides thereof through filters to cool the fuel cell, and the air in the open space is caused to flow directly rearward to cool the batteries. With the above constitution, the air flow caused as the vehicle runs is drawn for example from the front right and left sides of the vehicle body and caused to flow through the battery holding area on the right and left sides of the vehicle interior to cool the batteries. The air is also drawn with the fan into the fuel cell holding area to cool the fuel cell.

[0043]

According to the constitution in which the motor controller is placed behind the fuel tanks, the motor controller

is separated from the fuel cell, a heat source, through the fuel tanks interposed in between, so that the motor controller is less affected with the heat to maintain reliable control function.

[0044]

With the arrangement in which the opening in the partition wall is provided with the air vent direction switching means, for example, in summer, waste hot air can be directly released through the opening rearward of the vehicle body and, in winter, the hot air can be directed to the riders on the seat to make the ride comfortable.

Brief description of the drawings.

FIG. 1 is a top view of an electric motor-operated vehicle to which the present invention is applied.

FIG. 2 is a side view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 3 is a front view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 4 is a rear view of the electric motor-operated vehicle to which the present invention is applied.

FIG. 5 shows the vehicle body frame constitution of the electric motor-operated vehicle of the present invention.

FIG. 6 is a wiring diagram of the electric motor-operated vehicle of the present invention.

FIG. 7 is a plan view of an embodiment of the present invention.

FIG. 8 is a side view of the embodiment shown in FIG. 7.

FIG. 9 is an oblique view of a partition wall of the embodiment shown in FIG. 7.

FIG. 10 is an explanatory view of the base seats of the embodiment shown in FIG. 7.

FIG. 11 shows another example in cross section of the partition wall between the fuel cell and the hydrogen tanks.

FIG. 12 shows how the hydrogen tanks are mounted in another embodiment of the present invention.

FIG. 13 shows the piping system of the present invention.

FIG. 14 shows the piping routed on the vehicle body shown in FIG. 13.

FIG. 15 is a partial front view of the piping shown in FIG. 14.

FIG. 16 is a plan view of location of the drain pipe of the fuel cell of the present invention.

FIG. 17 is the side view of location of the drain pipe shown in FIG. 16.

FIG. 18 is a plan view of another example of the piping layout.

FIG. 19 is a plan view of another embodiment of the present invention.

FIG. 20 is a side view of the embodiment shown in FIG. 19.

FIG. 21 is a plan view of another embodiment of the present invention.

FIG. 22 is a side view of the embodiment shown in FIG. 21.

FIG. 23 is a plan view of another embodiment of the present invention.

FIG. 24 is a side view of the embodiment shown in FIG. 23.

[Explanation of Reference Numerals & Symbols]

1: Electric motor-operated vehicle 2: Vehicle body 3: Seat 4: Steering wheel 5: Front wheel 6: Front cowl 7: Main frame rail 8: Rear wheel 9: Loading platform 10: Vehicle body cowl 11: Cross member 12: Side frame rail 13: Bracket 14: Loading platform receiving frame 14a, 14b: Side rail 15: Strut 16: Floor plate 17: Brake pedal 18: Right front wheel brake cable 19: Left front wheel brake cable 20: Right rear wheel brake cable 21: Left rear wheel brake cable 22: Throttle cable 23: Shift cable 24: DC/DC converter 25: Hydrogen tank 26: Base seat 27: Battery 28: Partition wall 29: Fuel cell holding

section 30: Fuel cell unit 31: Fan 32: Filter 33: Partition wall 33a: Top portion 33b: Vertical wall portion 34: Opening 35: Air intake port 36: Electric motor 37: Electric motor controller 38: Receiving plate 39: Holding fitting 40: Switching cover 41: First fuel supply port 42: Second fuel supply port 43: Fuel pipe 44: Main check valve 45: Fuel filler inlet (Manual valve) 46: Relief valve 47: Fuel drawing pipe 48: Filter 49: Pressure regulator 50: Lock-off valve 51. Flowmeter 52: Air pump 53: Air pipe 54: Drain pipe 55: Manual valve

[Document Name] Abstract

[Abstract]

[Object] To provide an electric motor-operated vehicle in which the fuel cell and its related devices are cooled efficiently with a simple constitution.

[Constitution] An electric motor-operated vehicle 1 comprising: a seat 3 located in about the center of a vehicle body 2, a loading platform 9 located behind said seat 3 to hold baggage, main frame rails 7 disposed in the longitudinal direction of said vehicle body 2, a loading platform receiving frame 14 connected to said main frame rails 7, an electric motor 36 for driving the vehicle 1, batteries 27 for supplying power to said electric motor 36, a fuel cell 30 for charging said batteries 27, fuel tanks 25 connected to said fuel cell 30, and an electric motor controller 37 for drive-controlling said electric motor 36, wherein said fuel tanks 25 are placed in about the center of the vehicle width, said fuel cell 30 is placed in front of said fuel tanks 25 and under said seat 3, a partition wall 33 having a vent opening 34 is placed between said fuel tanks 25 and said fuel cell 30, a fan 31 is provided to cool said fuel cell 30, and cooling air is drawn with said fan 31 into said fuel cell holding area 29 and vented rearward through said opening 34 formed in the partition wall 33.

[Selected Drawing] FIG. 7

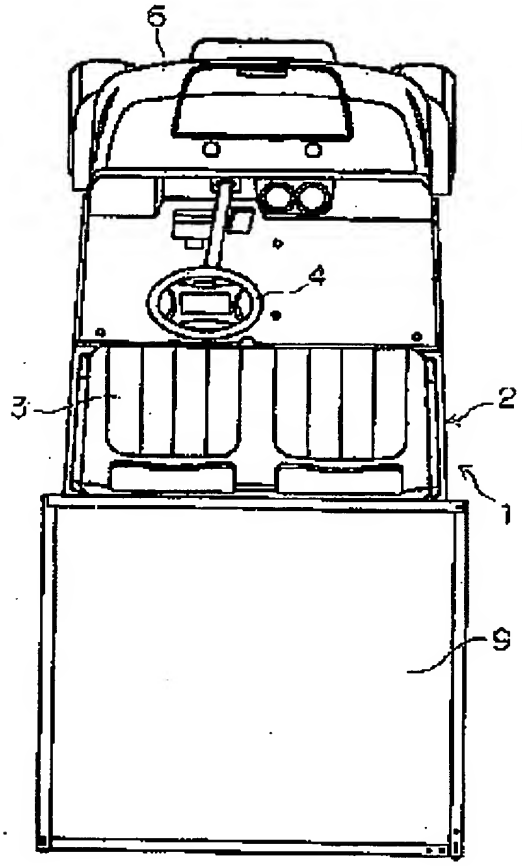

FIG. 1

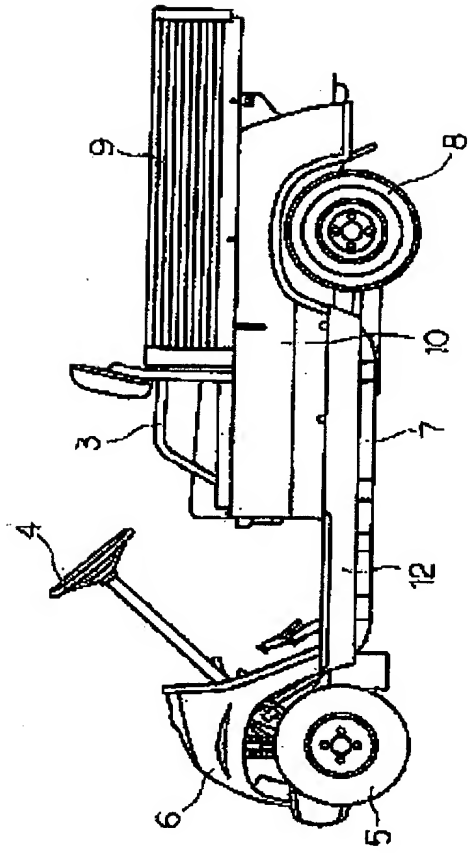

FIG. 2

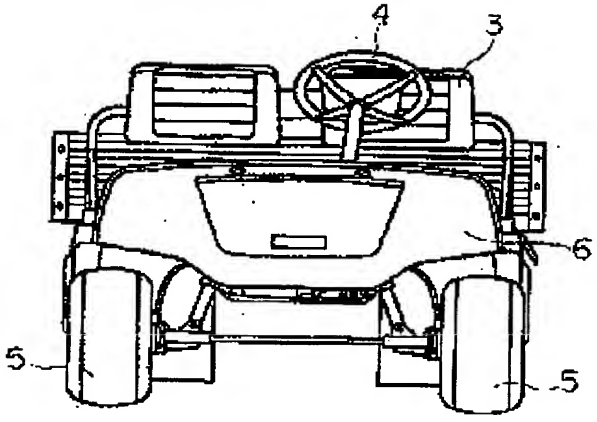

FIG. 3

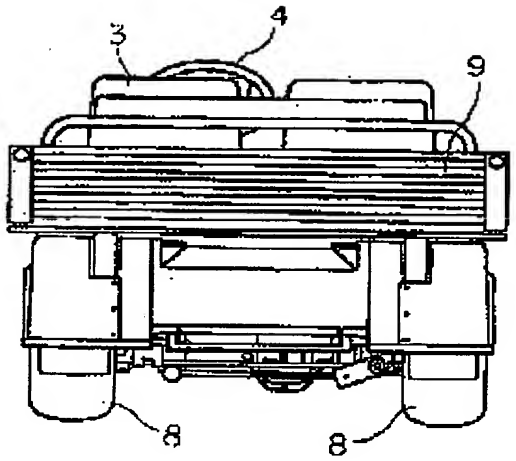

FIG. 4

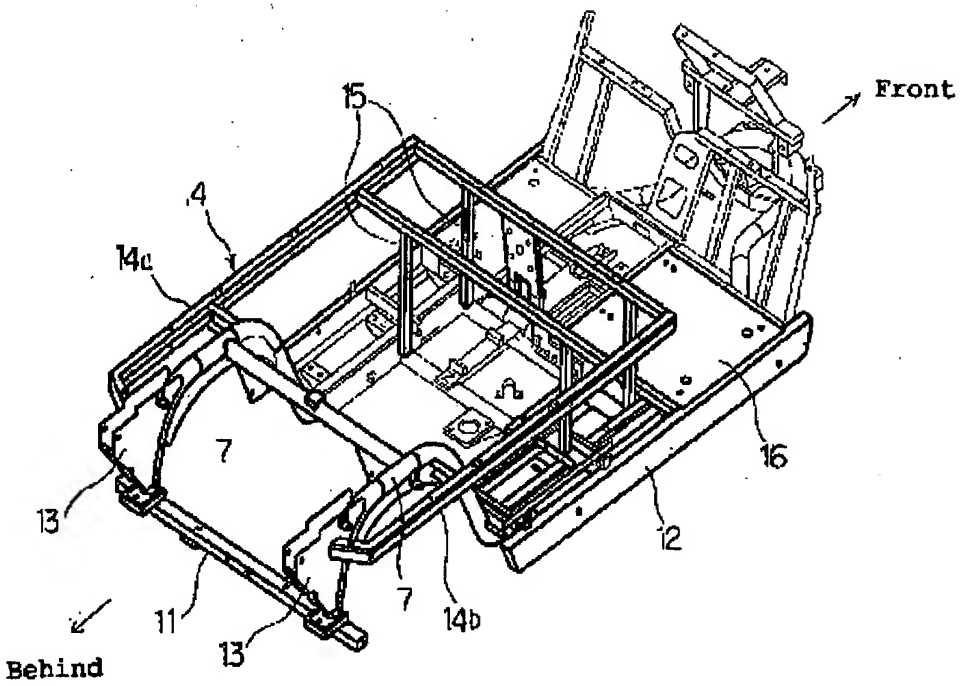

FIG. 5

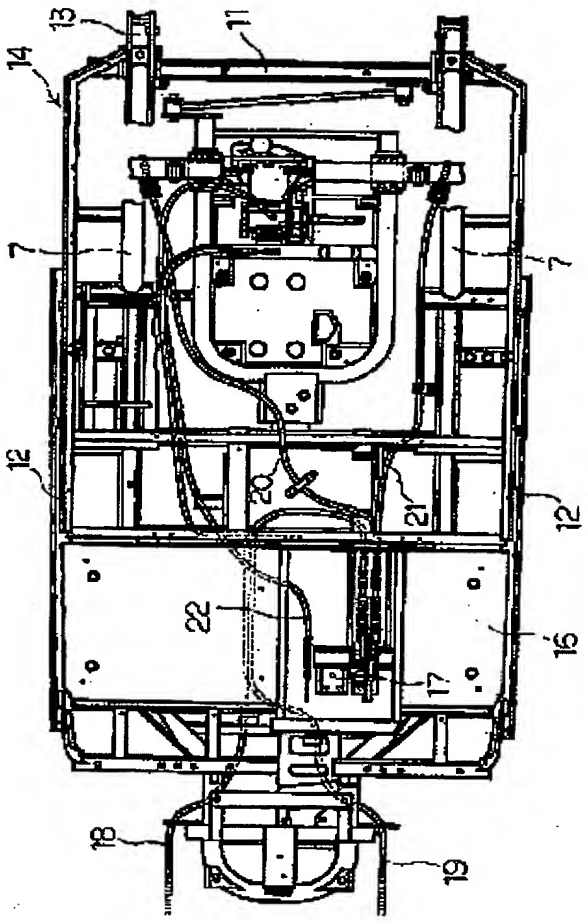

FIG. 6

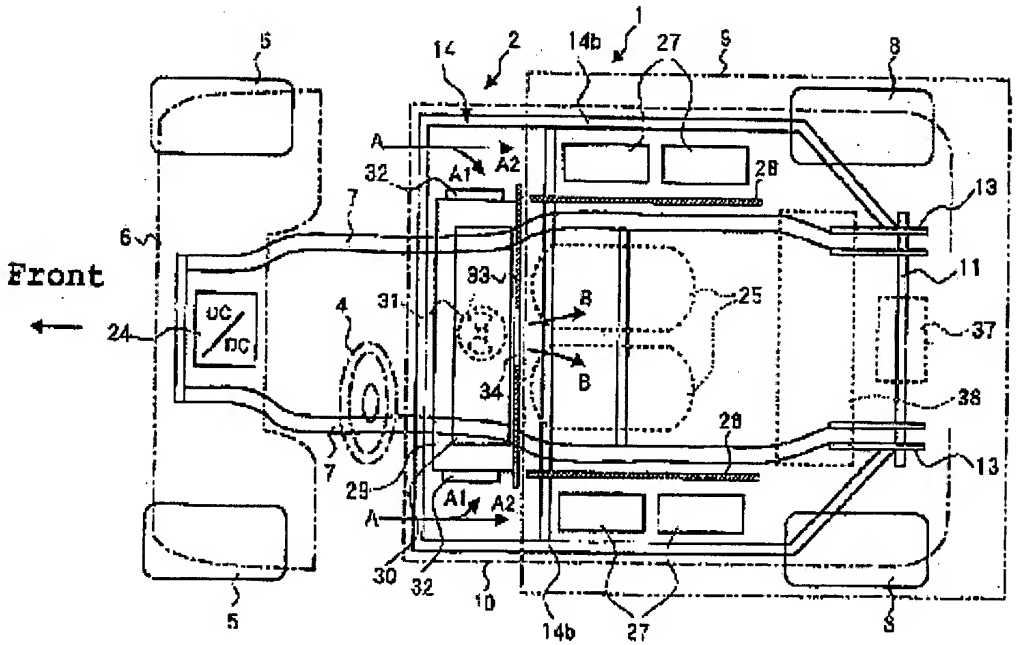
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FIG. 7

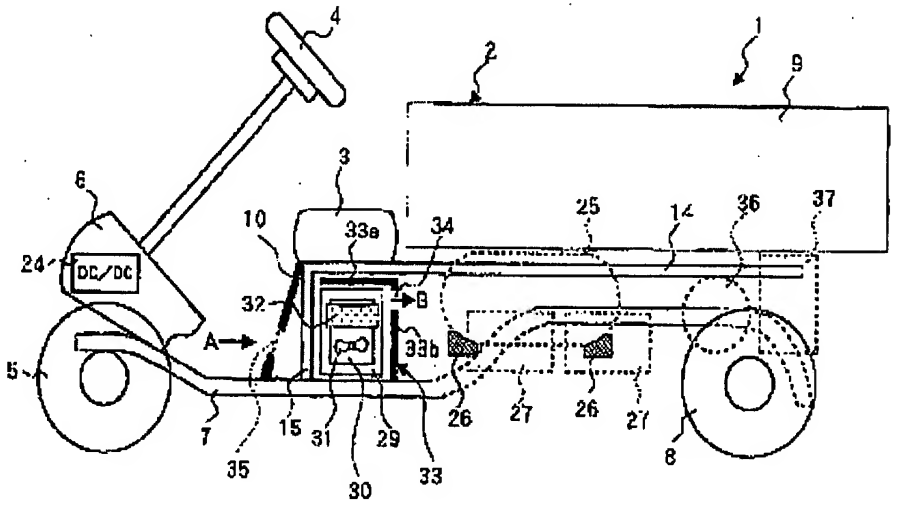
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FIG. 8

FIG. 9

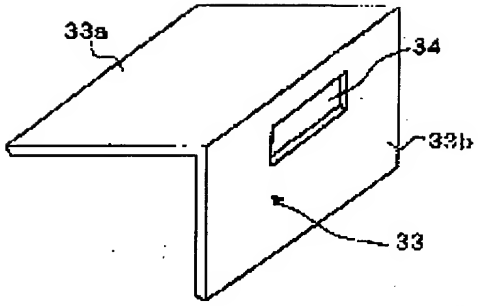


FIG. 10

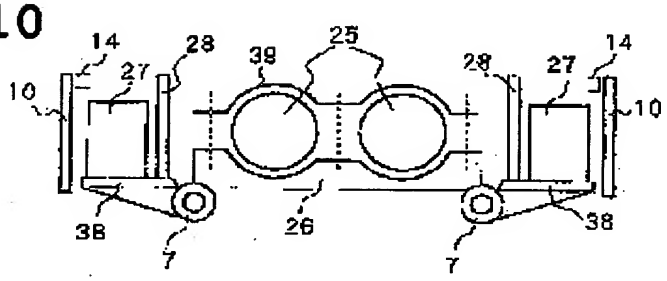
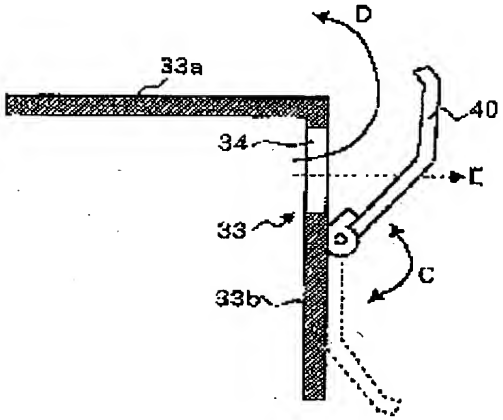
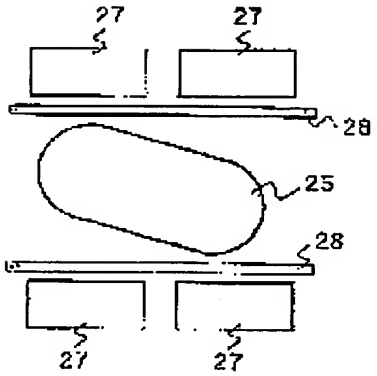


FIG. 11



(A)



(B)

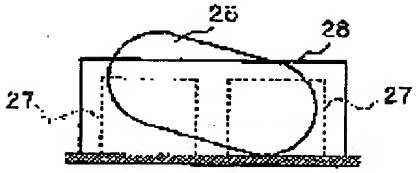
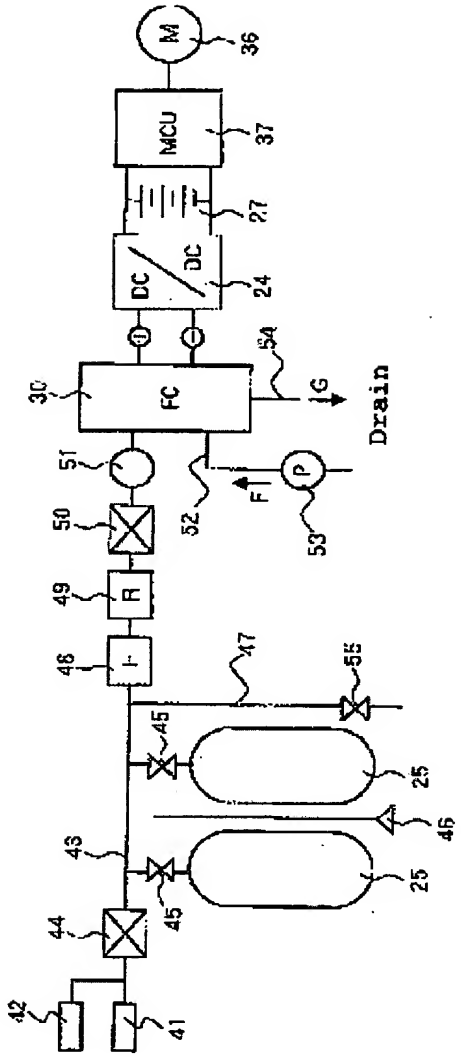


FIG. 12


M
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MCU
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DC
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FC
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FIG. 13

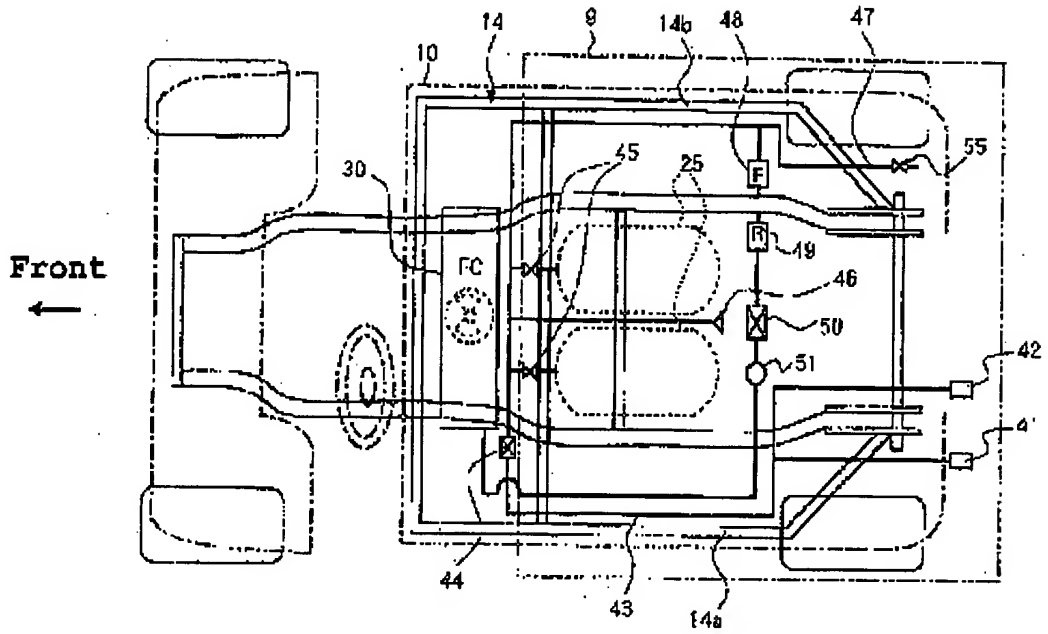


FIG. 14

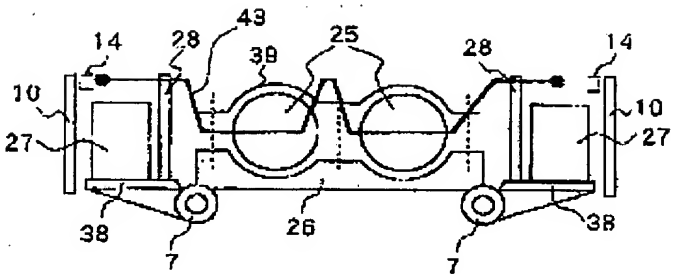


FIG. 15

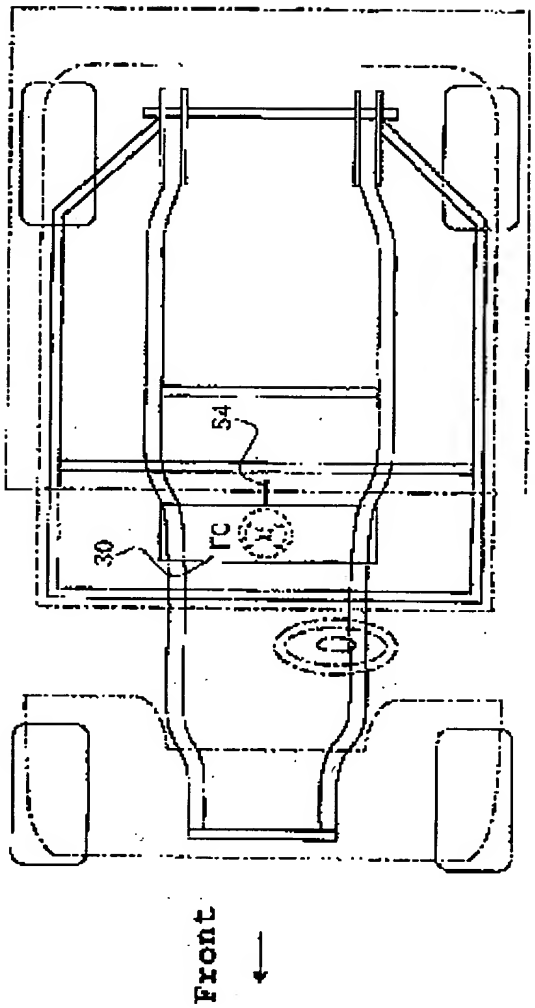


FIG. 16

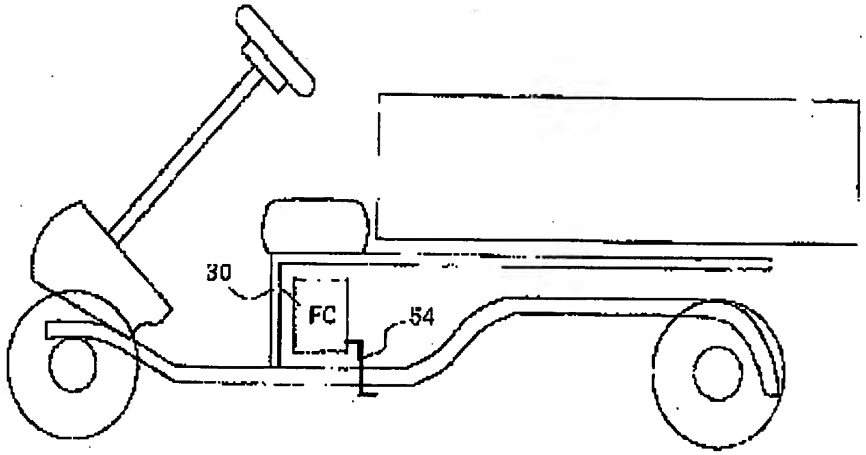


FIG. 17

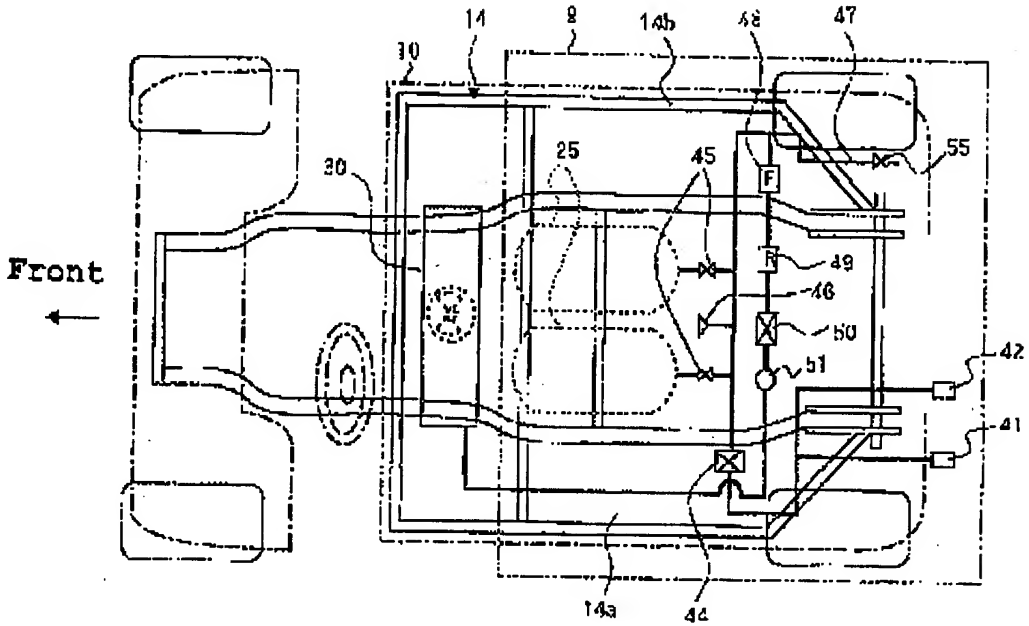
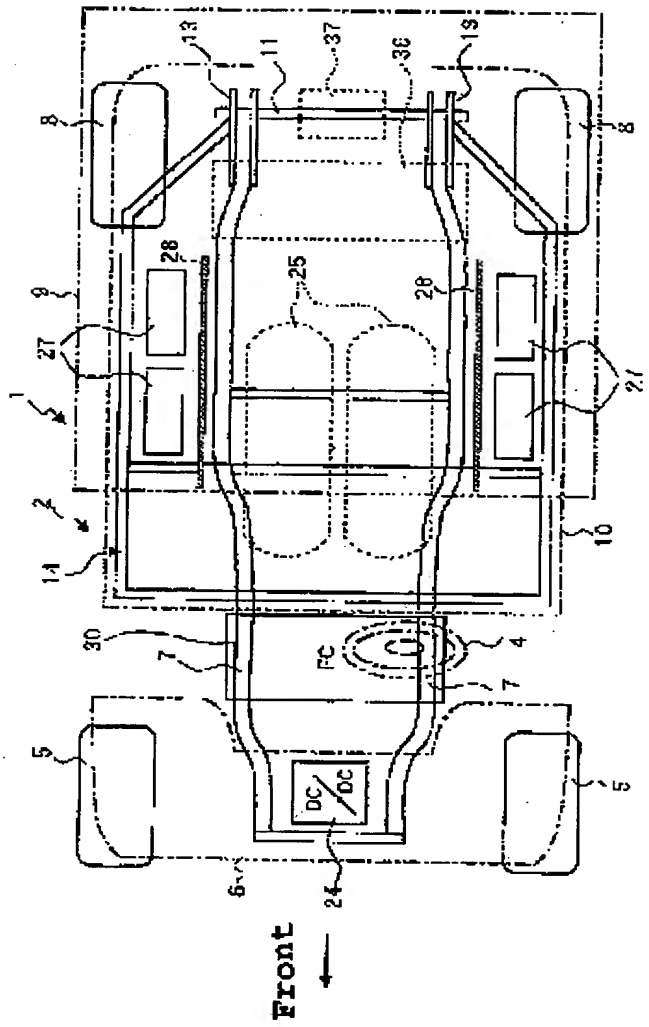


FIG. 18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Front

FIG. 19

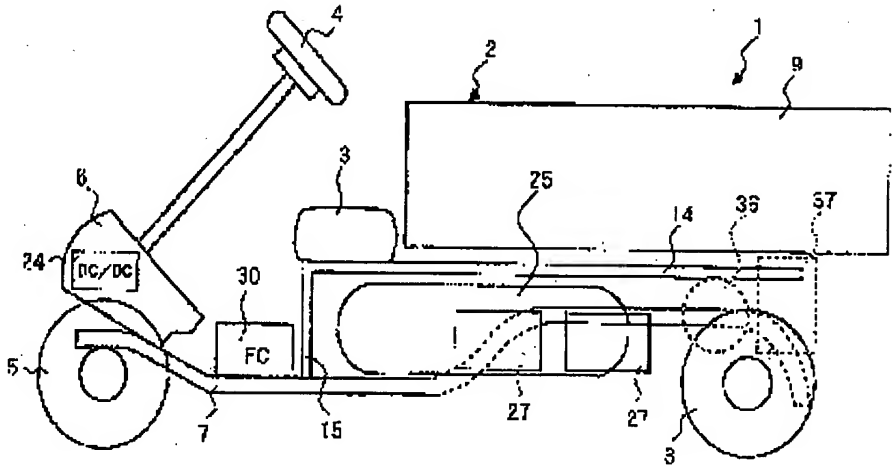

FIG. 20

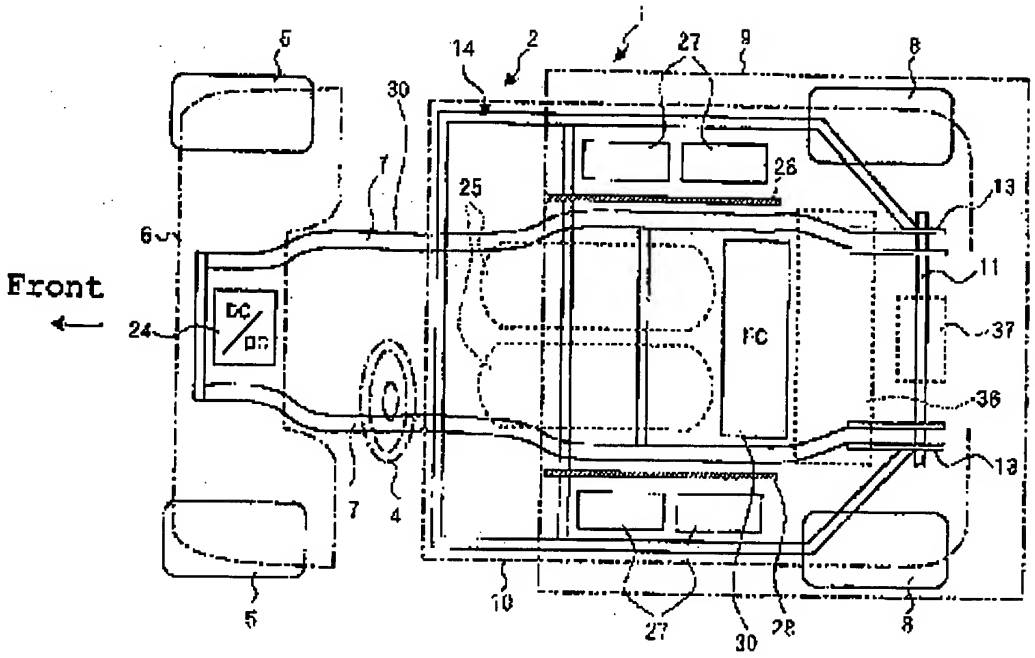
Front
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FIG. 21

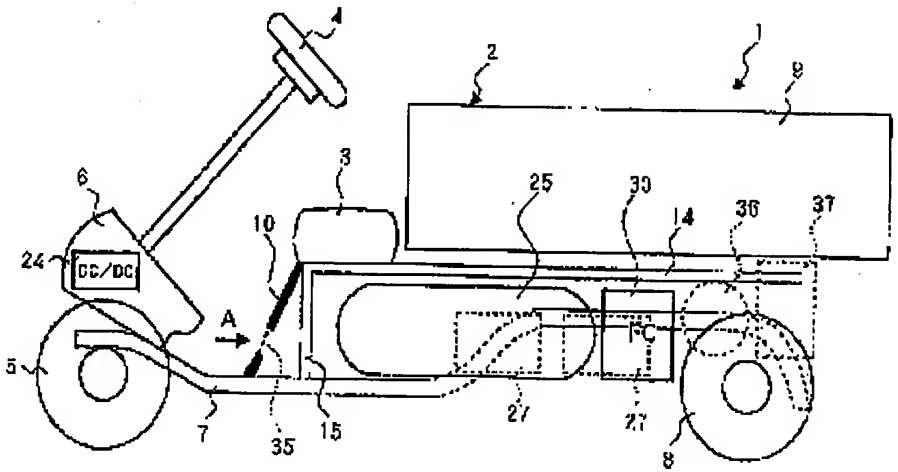

FIG. 22

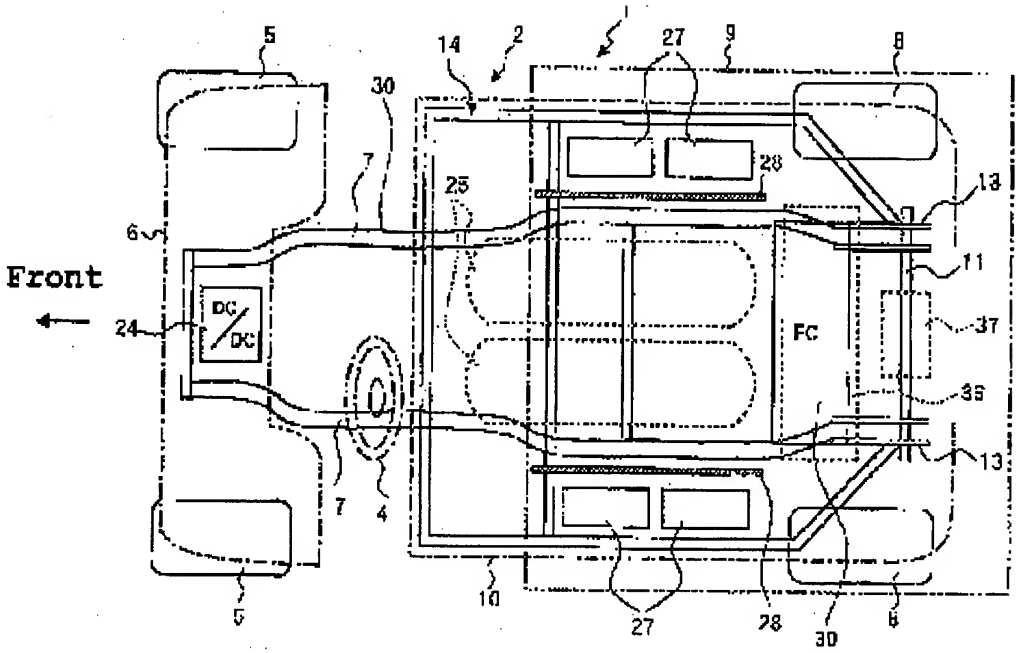

FIG. 23

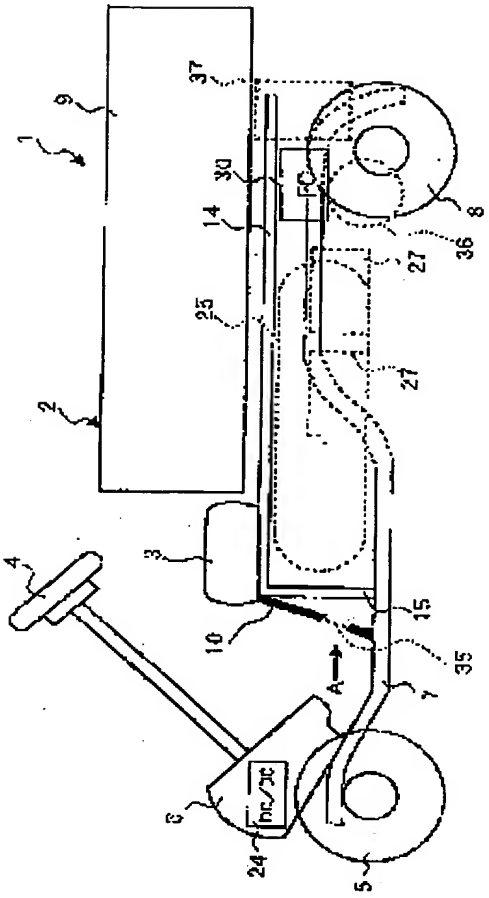

FIG. 24